

AIRCRAFT CIRCULARS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 174

THE D.H. "DRAGON MOTH" COMMERCIAL AIRPLANE (BRITISH)

A Twin-Engine 6-Passenger Biplane

Washington
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A Twin-Engine 6-Passenger Biplane

The latest addition to the series of successful De Havilland types is the "Dragon Moth" or D.H. 84. This has the distinction of being the first twin-engine airplane to be built by the firm.

The "Dragon Moth," which was designed primarily for commercial purposes, is a twin-engine braced biplane with a fuselage that completely fills the gap between the wings. It is remarkably clean, and aerodynamically is interesting for its low span loading, caused by its high aspect ratio. The inner sections are tapered in plan and the extensions sweep back so that the swept-back leading edge is continued in a straight line out to the wing tips. (Figs. 1, 2, 3, and 4.)

A thin airfoil section with no concavity on the under surface has been used and this may account for the excellence of the aileron control which has proved to be remarkably good in spite of the large span of the airplane.

An important contribution to the cleanliness of design has been the introduction of a new form of divided landing gear which might be described as semicantilever. The number of moving parts has been reduced to a minimum, and consists solely of the telescoping members of the shock-absorbing legs.

The outer casing of each shock-absorber strut is rigidly braced inward to the fuselage and aft to the rear spar. The sliding member, which consists of a square tube and carries a stub axle, slides within a collar at the end of the outer casing. The small number of moving parts is expected to reduce the cost of maintenance.

Although the makers have not yet had a great deal of experience with the type, the "Dragon Moth" appears to fly fully loaded with one engine stopped. But quite apart from the additional security conferred by this protection against forced landing, the duplication of the power plant

*From The Aeroplane, December 21, 1932.

has made possible the provision of an excellent outlook for the pilot who sits in the extreme nose of the fuselage and has an unobstructed view of the whole of the forward hemisphere.

The airplane is built of wood, with plywood covering for the fuselage and fabric for the wings. The method of construction used for the fuselage is that which has been developed by the De Havilland Company as the result of their world-wide experience and has been proved to withstand satisfactorily all the varied assaults of climate and weather.

Its weight empty, without cabin equipment, is 2,200 pounds, and as the maximum permissible loaded weight is 4,200 pounds, the disposable load is 2,000 pounds. This ability to carry nearly its own weight is a remarkable achievement for any airplane, and for a twin-engine airplane with the performance of the "Dragon Moth," it is excellent.

If one assumes a weight of 160 pounds for the pilot, 462 pounds for 60 gallons of fuel and 39 pounds for 4 gallons of oil, 1,339 pounds are left for pay load. A cruising speed of 110 mi./hr. is claimed with a consumption of 12 gallons per hour, so that the "Dragon Moth" should carry half a ton of pay load for five hours, the actual distance covered at 110 mi./hr. obviously depending on the wind.

An illustration of the economy effected by this combination of high cruising speed and low fuel consumption is provided when one passenger is carried 100 miles in one hour on 2 gallons of fuel - actually about 55 miles per gallon per person.

At the time of writing the "Dragon Moth" has not yet been flown over the speed course, but actual tests have shown it to be faster than two "Puss Moths" which were raced against it. According to official regulations the airplane has to clear an obstacle 66 feet high in 456 yards from standstill when the wind is less than 5 mi./hr. The actual height reached by the "Dragon Moth" in this test was 145 feet, which actually beat the official camera. The airplane climbed to 3,240 feet in five minutes.

The first three "Dragon Moths" have been equipped to carry 6 passengers and 45 pounds of baggage per person. The standard cabin equipment consists of 6 chairs, carpet, upholstery and decorations, and weighs 100 pounds.

As the cabin measures 9 feet 9 inches long by 4 feet 6 inches wide and 4 feet high, there is plenty of room. The windows run the full length of the cabin each side and they are made of celluloid, which has proved the best for the purpose under operating conditions. Each passenger has a controllable air duct close at hand.

The airplane has a variety of applications, ranging from freight carrying or joy riding to that of a luxurious transport.

The installation of radio is optional, but as the duplication of the power plant makes the type particularly suitable for crossing stretches of water, one imagines that this feature will be much in demand.

An important feature from the operator's standpoint is the folding of the wings. The extensions hinge about the rear spars and fold back parallel to the fuselage. In this position, folding links (fig. 5), with a hinge in the middle like a 2-foot rule, are used to bridge the gaps between the front spars. By this means the span is reduced to 25 feet 4 inches.

The wing is a braced biplane with swept-back leading edge and positive inner sections taper in plan outward from roots. A stagger is used with a positive dihedral on both wings. Inner sections are attached to upper and lower longerons of fuselage and interplane struts at ends. The lower inner sections, on which engines are mounted are braced upward to top fuselage longerons by pairs of parallel steel tube struts. (Figs. 6 and 7.) The extensions have trailing edges for the most part parallel to leading edges and hinged about rear spars in normal D.H. fashion. Folding tie rods bridge the gaps between front spars when extensions are folded and hold them in position. Steel tube interplane struts, normal D.H. wooden construction with solid spruce spars routed to I section, tubular steel compression members, and wire drag bracing are used with the usual D.H. wooden ribs and fabric covering. Ailerons are on all four wings linked together with struts and operated by usual D.H. differential mechanism in lower wings.

The fuselage is rectangular in cross section with wooden box construction of spruce members and plywood, the whole covered with fabric. Zip fasteners in fabric panels along belly of fuselage provide access to controls.

The tail unit is the normal monoplane type with wire bracing from fin and fuselage to rear spars of stabilizer. The front spar is hinged to the screw jack. The rudder is balanced while the elevator is unbalanced. Fabric covering is used here also.

The landing gear is the divided semicantilever type with track of 12 feet. Each unit outer casing of shock-absorber leg is rigidly braced aft to rear spar and inward to fuselage. At the bottom of the outer casing is a rectangular section steel tube which carries the stub axle for the wheel and slides against rubber in compression. Dunlop intermediate pressure wheels and Bendix brakes are used. The tracking tail wheel consists of a low-pressure tire carried in fork sprung against rubber in compression. (Fig. 8.)

The power plant consists of two 130 hp Gipsy Major inverted engines carried on steel tube mountings which are attached at four points to the structure on the lower inner section. One 30-gallon fuel tank, with a Smith's contents gage, is carried in each nacelle in a cradle above and between spars. Each tank feeds its own engine through duplicated fuel pumps. One 2-gallon oil tank forms a part of the lower cowling of engine.

The pilot sits in the extreme nose within an enclosed and glazed cockpit. A Vee windshield of nonshattering glass with opening side sectors is provided. (Fig. 9.) The remainder is glazed with celluloid. The wheel and column control with parallel motion rudder bar and adjustable pedals are used. (Figs. 10 and 11.) The rudder has a bias gear. A tail-trimming wheel and indicator is provided on port side. The normal D.H. control for combined or differential application of brakes is installed. The instrument board is hinged while all engine instruments are on the nacelles. The door in the bulkhead behind the pilot gives access to the cabin. The entrance door is on the port side. A separate baggage compartment of 50 cubic feet capacity with door on starboard side is provided.

CHARACTERISTICS

Span	47 ft. 4 in.
Length	34 " 6 "
Height (tail up)	9 " 4 "
Width (folded)	25 " 4 "

Areas:

Wing	376 sq.ft.
Ailerons	34.6 "
Stabilizer	19.5 "
Elevators	17.4 "
Fin	5.7 "
Rudder	14.4 "
Weight empty	2,200 lb.
Disposable load	2,000 "
Weight loaded	4,200 "
Power loading	16.15 lb./hp

PERFORMANCES

Maximum speed	125-130 mi./hr.
Cruising "	110 "
Climb to 3,240 ft. in	5 min.
Flight duration	5 hr.

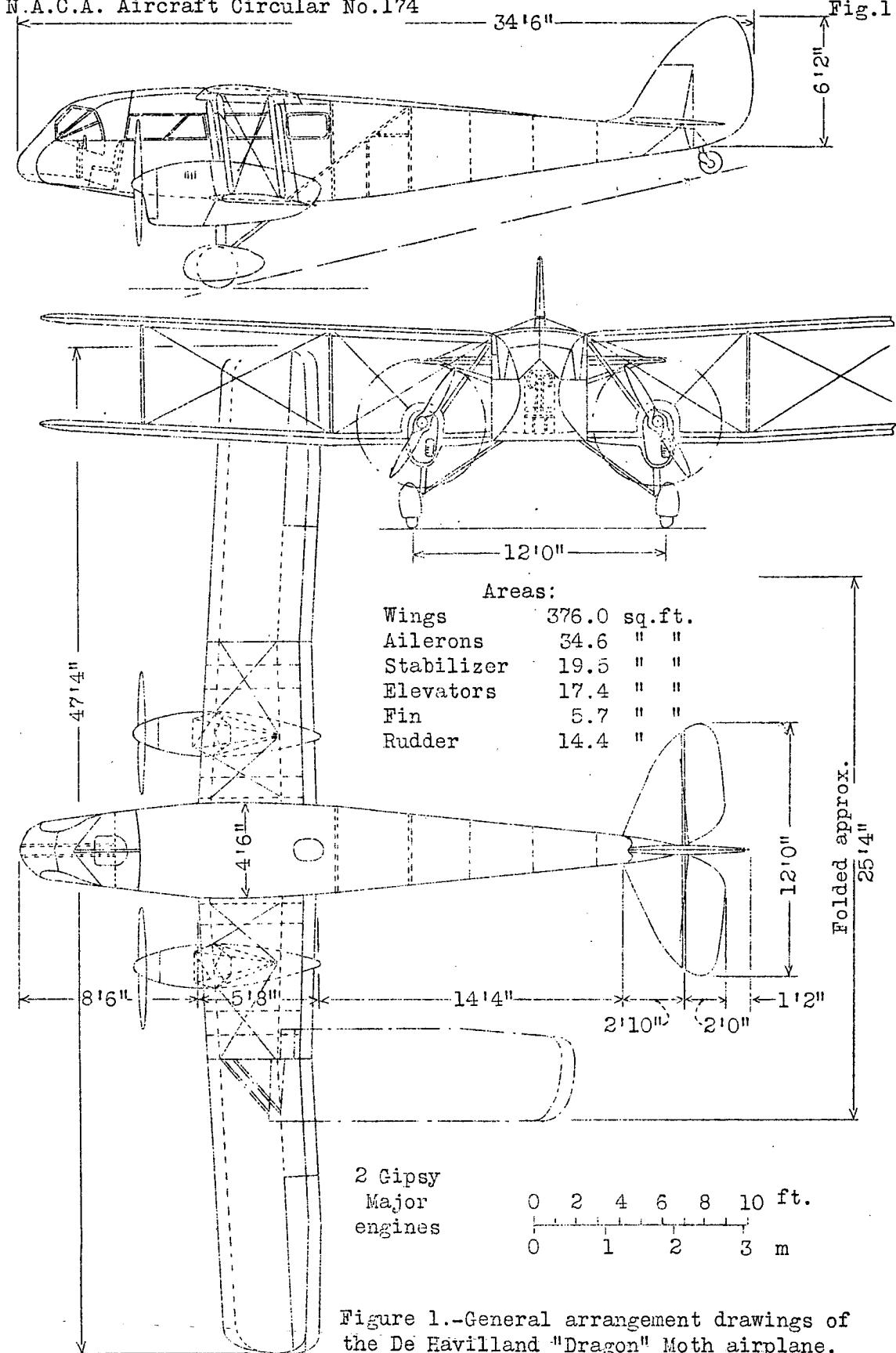
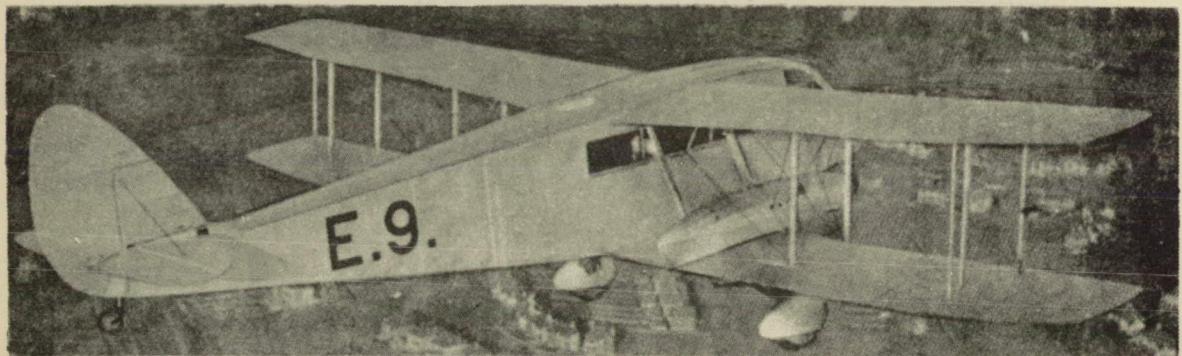
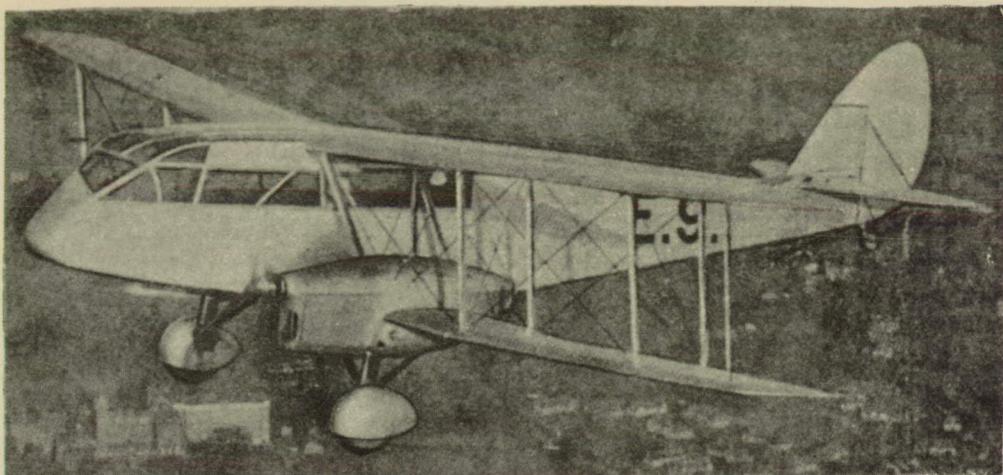


Figure 1.—General arrangement drawings of the De Havilland "Dragon" Moth airplane.



Figures 2,3.—Views of the De Havilland "Dragon" Moth D.H. 84 airplane in flight.

Photographs from "Flight".



Figure 4.
Close up
of the
De Havilland
"Dragon"
Moth airplane.
This photo-
graph of the
nose and
engines
illustrates
the good view
obtained by
the pilot,
and the care-
ful fairing
of the "Gipsy
Major" engines.
The landing
gear has a
low drag.

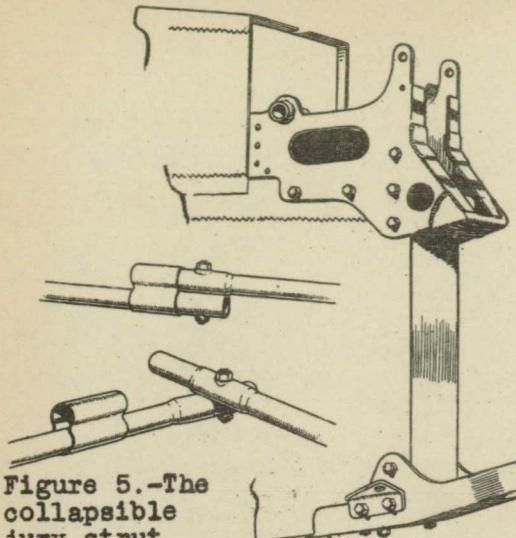


Figure 5.-The collapsible jury strut which extends when the wings are folded and holds them in position.

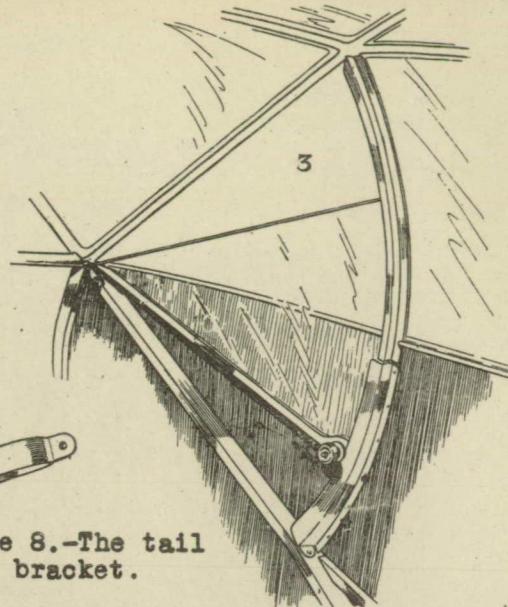


Figure 8.-The tail wheel bracket.

Figure 9.
One of the two openable windows along-side the pilots seat of the D.H.84 "Dragon" Moth airplane.

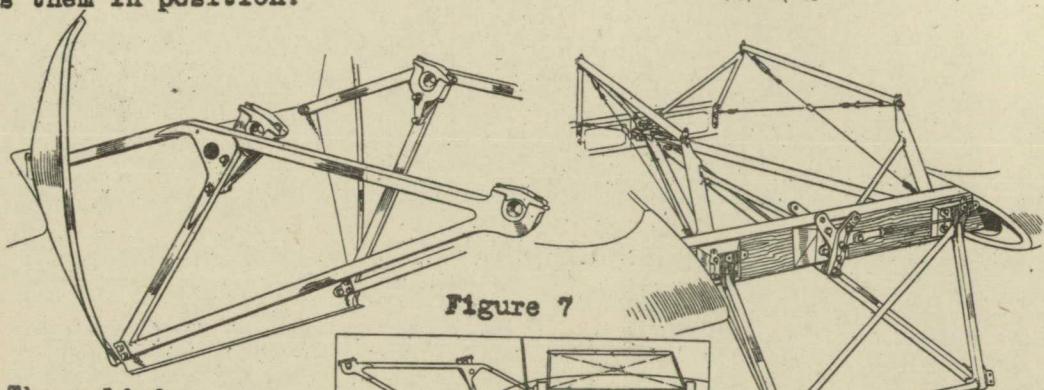


Figure 7

The welded-up square tube engine bearers, and fireproof bulk-head.

The engine mounting and tank brackets of the lower center section, with assembly in the center.

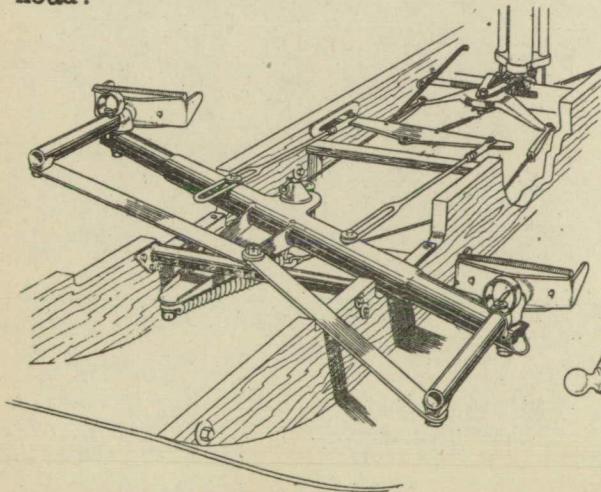


Figure 10.-Parallel action rudder bar.

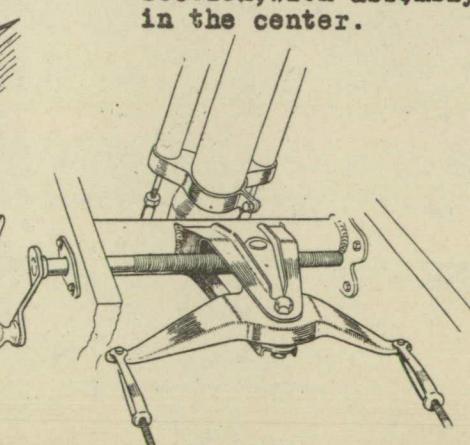


Figure 11.-Rudder-bias control which links up to the rudder bar by cables and a central spring.

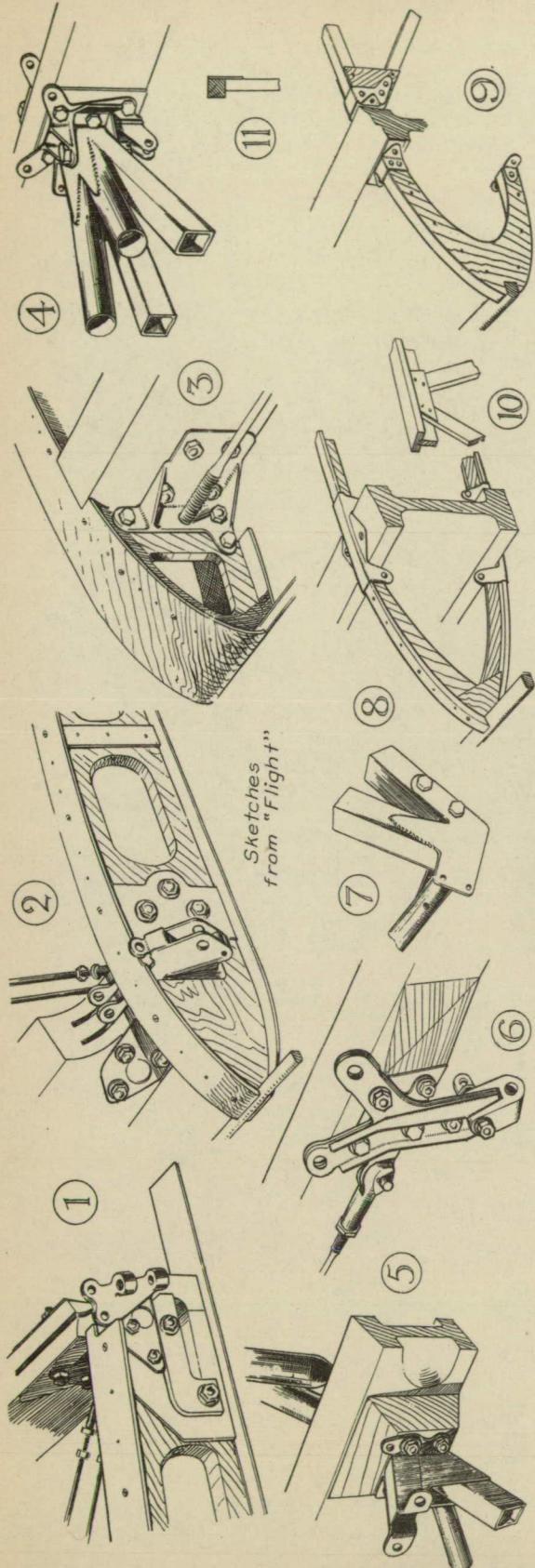


Figure 6.—Structural details
of the D.H. 84 "Dragon"
Moth airplane.

